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on Disaster Risk Reduction

Disaster risk reduction and changing dimensions and dynamics of future drivers

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DISASTER RISK REDUCTION AND CHANGING DIMENSIONS AND DYNAMICS OF FUTURE CRISIS DRIVERS

The dimensions and dynamics of crisis threats are increasing exponentially. Around the world assumptions about resilience and resource margins that protect societies from the impact of crisis drivers are being challenged; and, for those with roles and responsibilities to reduce the impact and consequences of such crisis drivers, new perspectives and methods are needed to anticipate and mitigate their effects. This chapter focuses on the types as well as the dimensions and dynamics of threats that one may have to confront in the foreseeable future. In so doing, it suggests that disaster risk reduction will have to deal not only with what are regarded as self-evident threats, but also with those that *might be*.

The future in context

It is perhaps folly to set forth to predict the future, and that is not the intention of this effort. Rather it is to suggest a framework in which the prospects for future crisis drivers and threats seem sufficiently plausible that a case is established to think more systematically about ways to anticipate their potential impact and to mitigate their effects. While this chapter will focus on a framework of plausible drivers and threats that should be considered as part of risk reduction, it is important to stress from the outset that *plausibility* should not be confused with *predictability*. The former ultimately is intended to change the ways that we think about risk, while the latter suggests far greater certainty and confidence than the results of most long-range forecasting allow.

It, too, should be stressed that the seemingly gloomy search for *what might be*'s is not to resurrect the spectre of Nostradamus, for as discussed in a related chapter, the capacities of the natural and social sciences and technology as well as sensible risk reduction policies can do much to offset even some of the most extreme crisis drivers and threats, no matter how plausible.[1]

The interaction between foreseeable changes in the wider global context and new types, dimensions and dynamics of future crisis drivers and threats is central to this analysis. In particular, of the myriad factors that one could identify, *futures* contexts in this case will be circumscribed by at least six core issues: [i] fluid multipolarity; [ii] growing centrality of crises; [iii] vulnerability and resilience; [iv] population growth and demographic shifts; [v] globalisation; and [vi] resource scarcity.

Fluid multipolarity. The assumption that state power is moving "east" and that the foreseeable future will reflect a new "hegemon" is missing the complex dynamics of a world in which there will be various fluid power blocs that will switch allegiances and alignments based upon relatively short-term interests and advantages. It is quite likely that in the foreseeable future that this emerging global construct will make risk reduction initiatives at global and

[1] See: Chapter __: Disaster Risk Reduction and the 21st Century Organisation

regional levels more difficult – a consideration of some concern if one takes into account the sorts of global and trans-regional risks that are increasingly evident – from the consequences of cybernetic failures to radio-active leakages, from pandemics to food security.

A case in point is what has been described as "the waters of the Third Pole."[2] In this analysis, the combination of meltwater and changing precipitation rates in the Hindu-Kush Himalayan region when combined with large scale demographic shifts to urban and peri-urban areas and the continuing construction of dams have intensified risks from the Himalayas to the deltic plains of Bangladesh. A regional solution to reduce such risks is vital; and yet, there is little evidence at this stage that the powers in the region are willing to deal with these risks collaboratively; and equally as noteworthy, the influence of those outside the region to promote regional solutions seems less and less effective;[3]

Growing centrality of humanitarian crises. Humanitarian crises have moved from the periphery of governmental interests to centre stage. Less and less are humanitarian crises regarded as aberrant phenomena, divorced from "normal life," and increasingly humanitarian crises are reflections of the ways that societies structure themselves and allocate resources. In that context, humanitarian crises will increasingly be imbued with high levels of political significance, and directly affect the ways that governments are perceived and survive. The growing centrality of humanitarian crises for governments means that disaster risk reduction, too, will be increasingly affected by political calculations pertaining to governments' survival;

Vulnerability and resilience. In light of the growing centrality of humanitarian crises, it is quite likely that governments may increasingly feel compelled to demonstrate their proactive attention to and involvement in anticipating potential crises. Commensurate with a growing frustration generated by the continuing bifurcation between development and humanitarian action, it is quite likely that the growing attention given to concepts of vulnerability and resilience will generate a new "security paradigm" that will result in a more comprehensive approach to humanitarian actions, incorporating issues of employment and livelihoods with prevention, preparedness and response[4];

Population growth and demographic shifts. The foreseen increase in global population through the mid-21st century has clearly exacerbated the potential impact that crisis drivers will have upon vulnerable populations. This will have at least three interrelated dimensions. The first is that populations in overpopulated areas already prone to disasters are increasing further.[5] Such

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[2] [[UCL Benfield Hazards Research Centre, HFP, China Dialogue, Waters of the Third Pole reference]]

[3] [[See: Katherine Morton, ANU]]

[4] Approaches to new forms of security are explored in Joshua Cooper Ramo's ***The Age of the Unthinkable***, [Little, Brown and Company, New York, 2009] pp….. Also note Development Initiative's work on SIDA evaluation.

[5]

population growth includes urban and peri-urban areas, riparian settlements and other areas regarded as highly disaster prone.[6] The second factor of relevance for those dealing with disaster risk reduction is the movement of populations due to actual or threatened disasters. Such population movements create risks for themselves and intensify risk for others. Finally, at least through the mid-point of this century, risk reduction calculations will have to take into account the sheer numbers of people that will have to be incorporated into risk management and reduction plans. The starting point for calculating risk reduction in terms of human vulnerability will have to take into account a much longer time frame, eg, four decades, when it comes to risk reduction planning and programming.[7]

Demographic shifts. Closely related to the issue of population growth is that of demographic shifts, more specifically the issue of movements from rural to urban areas.[8] This phenomenon is well accepted, and the challenges that face growing conurbations are very much on the agendas of DRR specialists. Overlooked, however, are not the major cities, but all too often medium and small conurbations that inevitably will be faced with disaster risks not dissimilar to larger conurbations. It is all too likely that they will face the future without comparable government attention and resources to offset such threats.[9] There, too, is a much underexplored set of issues that will require the attention of those concerned with DRR. One assumes that demographic shifts into urban areas are "one way" and for all intents and purposes permanent. An emerging reality may be that such shifts will be counterbalanced by permanent migration between rural and urban areas, and that what one calls peri-urban will in fact be a seamless growth of population centres without any clear geo-political boundaries;[10]

An added dimension is that populations may also move into what has been described as "no-mans lands", where large numbers of human-beings will be at risk but where there will be no conventional state capacity or interest in dealing with them.[11]

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[6] Norman Myers and Jennifer Kent expand upon this theme in ***Environmental Exodus: An Emergent Crisis in the Global Arena***, Washington, DC, Climate Institute, 1995, p.61ff. Their analysis still rings true when they suggest that those who are not in coastal areas or urban conurbations might find themselves living in what might be called "marginal lands," or, those areas where human activity has led to deforestation, water shortages and desertification. At the same time, because of population pressures, more and more people will be forced to migrate to marginal lands, living in areas [eg, hill tops] where the prospects for livelihoods are relatively limited. Myers and Kent makes a "preliminary and exploratory" though admittedly cautious and conservative estimate that today 630 million people live in low productivity agricultural areas, 57% of whom try to survive in areas prone to environmental hazards, including soil erosion, floods and droughts. Eventually, according to the authors, one can foresee 50 million climate change refugees seeking to escape such marginal lands.

[7] [[40 cities and the future]]

[8] [[UN HABITAT]]

[9] [[Karin Hudson Edwards & Noah Raford]]

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[11] [[Op cit #6 – RCK to get page number]]

The Globalisation paradox. The paradox of globalisation is that it brings localisation to the fore.[12] One might suggest that, as greater awareness about the interconnected nature of everything from the economy to the transmission of disease increases, the greater is the awareness of the diversity that imbues most regions of the world. In that context, a recent study about emerging vulnerabilities in the Hindu-Kush Himalayan region suggested that a major challenge facing those attempting to map potential threats was the number of ethnically and linguistically diverse communities, many of which were unfamiliar to their own respective governments and in some instances even local authorities.[13] Another dimension of this paradox of course is the fact that disaster risk reduction inevitably will have to be more regional and global in scope than is normally foreseen. As will be discussed in the next section, this perspective is part of the changing dimensions of future crisis drivers for which DRR will have to be increasingly attuned;

Resource scarcity. Resource scarcity suggests both new types of crisis drivers and changing contexts in which DRR will have to take place. Certainly in the immediate future, policy-makers – confronted in the immediate future with a general need to reduce budget deficits -- may well be tempted to focus on immediate crises rather than those which are plausible but not seen as imminent. This means that many aspects of DRR may well be relegated to the category of a financial non-essential, merely re-enforcing a tendency that has been all too familiar for those who have and continue to advocate for DRR's importance. This propensity may well be further exacerbated by a decline in traditional donor budgets for a range of non-humanitarian requirements beyond, leaving poorer countries doubly disadvantaged.

It is in this plausible context that those responsible for disaster risk reduction need to consider the types of crisis drivers and types of crises that will have to be faced in the future. In suggesting what such crisis drivers and crises might look like, it is important to bear in mind that though these may be plausible, they are not inevitable. In the first instance these are not predictions, but rather possibilities; in the second, effective disaster risk reduction could well mitigate such threats, but as will be described elsewhere will require amongst other things will and a greater commitment to dialogue with the sciences.[14]

Crisis drivers of the future

The types of crisis drivers and ultimately the types of crises that need to be anticipated will change in many respects the concept of vulnerability. In a very fundamental way, assumptions about the nature of "hazard prone countries" and hazard propensities will have to be reassessed as one begins to speculate about the changing nature of crises drivers and their dimensions and dynamics. In extremis, NASA's Task Force on Planetary Defense warns that the international community has to increase its capacities to deflect in-coming asteroids – a suggestion endorsed by the White House's Office of

[12] [[See Humanitarian Horizons paper on globalisation]]
[13] [[Waters of the Third Pole, also refer to the political nature of localisation]]
[14] [[refer to third GAR-HFP paper]]

Science and Technology Policy. These are seen as plausible and indeed possible threats, threats for which one can prepare through the creation of relatively inexpensive deflection systems. Such threats will be general in their impacts, and will defy the proposition that those who are poorest are necessarily the most vulnerable.[15]

Hence, the conventional adage that crisis drivers expose the vulnerability of the poor will in many ways serve the DRR community, but at the same time emerging crisis drivers will not only put an end once and for all to the assumptions of the "hapless South" and "resilient North," and also will blur the socio-economic demarcations of vulnerability. In other words, the types of crisis drivers of the future may in some instances have greater impact upon the socio-economic advantaged than the disadvantaged.

Types of future crisis drivers. The dimensions and dynamics of conventional crisis drivers, such as volcanic eruptions, floods and earthquakes, will increase exponentially, principally because of a confluence of such hazards and what were described above as context factors, economic short-termism and environmental changes, including climate change. They will join a growing number of technological and ill-considered infrastructural threats that will intensify vulnerability across the globe. Some of these new crisis drivers will be part of the *desiderata* of spent technologies or the consequence of poorly planned "development"; others will derive directly from technologies presently in use, while others will be the result of the abuse of such technologies.

In the first category, it is evident that there is a growing link between disaster risks and abandoned technologies. In this category, the potential catastrophes that could arise within Central Asia and beyond from radioactive waste and nuclear tailings are cases in point. According to one analysis, the festering remnants of the Soviet nuclear arms industry could poison significant portions of the water sources and agricultural lands of countries in the region, and – in a resource strapped environment – could ultimately be the source of conflicts within and between those countries. Such waste could also have far more extensive effects if caught in airstreams that carry it well beyond the region, itself.[16] Similarly the "red sludge" from a burst bauxite storage reservoir near the Hungarian town of Ajka offers another case in a growing number of examples in which the sheer cost and complexity of industrial and waste storage around the world are exacerbating risk.[17]

Technology's impact upon vulnerability is also reflected in issues such as cybernetic collapse, nanotechnology and biotechnology. All three reflect scientific innovations that will be increasingly important and positive parts of modern society, while at the same time all three will present potential hazards

[15] [[See Task Force on Planetary Defense of the NASA Advisory Council. Note that estimates for deflection systems are $250 to 300 million, with an annual maintenance budget of $75 million. Also reference White House Office of Science and Technology Policy message to US Congress October 2010]]
[16] [[See C. Hobbs chapter]]
[17] [[Note Ajka crisis]]

that could generate vulnerabilities which in turn could translate into large-scale crises. Only recently the British government ranked cybernetic terror as the second greatest threat to the nation,[18] and the negative as well as positive aspects of nanotechnology and biotechnology have been a source of considerable debate over the past decade.[19]

The disaster risks that will emerge from what might be regarded as "poorly planned development" are numerous and frequently recognised as such. The evident dilemma for policy-makers is the need to reconcile seemingly incompatible objectives, for example, between economic growth and longer-term risk. Hence, displacement caused by large infrastructure projects, especially dam construction, has become common in China – as in other countries within the Asian region – in response to the escalating demand for electricity and water associated with rapid urbanisation. The sorts of risks that projects such as China's Three Gorges Dam create are reflected in the potential environmental catastrophe that is forecast in the aftermath of moving more than 1.4 million people away from in and around the dam site.[20]

Response to reduced water supply in Minqin County, China

In Minqin County, Gansu, problems of water supply have been increasing over the past two decades. The oasis there is fed by the Shiyang River, with headwaters located in the Qilian range. Snowfall on the mountains has been steadily decreasing, with snowlines retreating at an average rate of around 2 metres per year. The amount of water flowing annually into the oasis via the Shiyang has fallen from an average of 400–600 million cubic metres in the 1960s to just 85 million in 2002. If current trends continue, the river is expected to be virtually dry before the end of this decade. To date, the county's people have resorted to ever-increasing levels of groundwater extraction. A recent report estimates that non-sustainable groundwater extraction in Minqin County is currently 428 million cubic metres per year, causing groundwater levels to fall by an annual average of 0.4–1.0 metres. Consequently, authorities have developed a strategy to reduce local population in line with falling water availability, thus attempting to use environmental migration to mitigate environmental problems, and attracting widespread criticism within China and abroad.

However, while these "Hobson's choices" may possibly be inevitable, the equally disturbing fact is that the full consequences of such choices are not analysed or understood sufficiently. As highlighted in the recent controversy over the Zipingpu dam's contribution to the 2008 earthquake in Sichuan, dams can end up becoming agents of their own demise. The pressure of the water in lakes of several square kilometres locked behind a large dam may contribute to an increase in the seismic activity beneath it, especially if the

[18] [[Follow-up BBC story, 16 Oct]]

[19] "There are a great many studies on cells and animals suggesting that nanomaterials can have damaging effects on the health and the environment," says conference organiser Professor Bengt Fadeel, vice chairman at the Institute of Environmental Medicine at Karolinska Institutet. "When you shrink material down to the nanoscale, you change their properties and we still don't really understand which properties are hazardous." , *Swedish Research institutions warns on health hazards of nanotechnology*, Finfact Ireland 15 October 2010

[20] Xinhua News Agency (2010a) ,'International scientists to launch environmental studies on "HKH region"'8 March 2010 http://news. xinhuanet.com/english/2010-03/09/content_13129540.htm

dam is built directly over a fault. [[Add arsenic poisoning in Bangladesh and the US West Coast]]

"One of the greatest disasters of all times": Arsenic poisoning[21]

More people are affected by arsenic poisoning in Asia than in the rest of the world combined, and possibly over 100 million people drink water containing more than 10ppb arsenic in Asia. Arsenic pollution is mainly associated with alluvial deposits in the basins of the major rivers that flow south and east of the Himalaya and Tibetan Plateau. The poisoning of tens of millions of Asians with arsenic is indeed one of the greatest disasters of all time. Without widespread and sustainable solutions the problem may well increase, particularly as water stress is predicted to increase in the future in many of the regions where groundwater is seriously contaminated with arsenic.
There are similar patterns of groundwater contamination in a near-continuous zone extending from the Indus River in Pakistan east to Taiwan – the South and Southeast Asian Arsenic Belt (SSAAB). Outside this belt, it is only the inland alluvial basins of Inner Mongolia, Shanxi and Xinjiang in China where arsenic pollution occurs on a similar scale.

[[Cornwall alert]]

Dimensions and dynamics. Hurricane Katrina, the BP oil spill in the Gulf of Mexico and the Russian firestorms of 2010 demonstrate that all geographical areas are vulnerable to the impact of crisis drivers, and that the severity of impact more often than not is a reflection of the ways that societies structure themselves and allocate their resource. Yet, whatever may have been characterisations about vulnerabilities in the past, it is increasingly apparent that the dimensions and dynamics of humanitarian crises are changing exponentially; and that those concerned about reducing disaster risks and their impacts will have to take both into account.

There are in this regard at least three issues that those involved in DRR will have to accommodate in preparing to address possible future risks. Each of these suggest that risk reduction will not have the luxury of looking at individual risks as isolated phenomenon, but will have to take into account the ways that a seemingly random number of potential risks interact. There may in this context be high impact and low frequency risks that can be triggered by high frequency and low impact risks; alternatively there may be very low frequency risks such as solar flares that may well trigger both.

From this perspective, the three dimensions of future crisis dynamics that should be borne in mind are [i] synchronous failures, [ii] simultaneous crises and [iii] sequential crises. Each emphasise the interactive nature of risk identification and reduction, and each stresses the need to look at both in terms of boundaries that transcend conventional geo-political demarcations.

[i] *synchronous failures*. "It's the convergence of stresses that's especially treacherous and makes synchronous failure a possibility as never before," noted Thomas Homer-Dixon in his seminal work, ***The Upside of Down***. "In coming years, our societies won't face one or two major challenges

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at once, as usually happened in the past. Instead they will face an alarming variety of problems – likely including oil shortages, climate change, economic instability, and mega-terrorism – all at the same time."[22] This describes *synchronous failures*.

On 26 July 2005 the Indian city of Mumbai was hit by the eighth heaviest 24 hour rainfall ever recorded, reaching 994 mm on one day and intermittently continuing the next day, depositing a further 644 mm. The resulting floods offer a brief micro glimpse into what a synchronous failure might be. It was not merely the impact of the floods on the sewage systems and the conventional infrastructure of Mumbai that brought the city to a halt, but what became more revealing was the impact that the floods had on a range of cybernet functions that greatly intensified the flood's impact.

Throughout the city ATM networks collapsed, a significant proportion of the Bombay and National Stock Exchanges became inoperative, for the first time in its history the Mumbai-Pune Expressway was closed, due in no small part to landslides, the Chatrapati Shivaji International Airport as well as smaller airports closed down. In other words for a 48 hour period, one of the largest and economically important cities in the world shut down. Across all aspects of economic, social and political life, it was almost impossible to function. Some of the causes that intensified the crisis became evident in the flood's aftermath. 40% of the mangrove ecosystems that served as buffers between land and sea were lost to shopping malls and the development of waste dumps. Despite periodic warnings over the past fifteen years about the consequences to infrastructure of over-building, the Environment Ministry merely stated that it was not practical to impose new guidelines with retrospective effect "as there are millions of buildings".[23] And in a related vein, the Brihanmumbai Municipal Corporation had maintained that the 1990 plan to enhance the city's drainage capacity to 50 mm per hour was too expensive, ie, 600 million Crore, or approximately US$130 million.[24]

[ii] *simultaneous crises*. In speculating about the types of future crisis drivers and crises that might have to be confronted in the future, it would seem evident that their impact and effects will be significantly greater. As Haiti and Pakistan reminded practitioners and policy-makers alike during 2010, the capacity to respond to such individual crises leaves the humanitarian sector overstretched. The challenge for that same sector is how to cope with the consequences of such events happening simultaneously. The prospect that a significant earthquake might happen in San Francisco in California while a major flood occurs in Mozambique cannot be dismissed; and while arguably one might say that such prospects fall to those involved in all the complexities involved in response, the issue, too, relates to disaster risk reduction.

The plausibility of major humanitarian crises occurring simultaneously re-enforces the importance of viewing DRR in the context of strengthening

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[22] Thomas Homer-Dixon, ***The Upside of Down: Catastrophe, Creativity and the Renewal of Civilisation***, Alfred A. Knopf, London, 2007, p 16

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regional, national and local capacities. The prospect that the "international humanitarian sector" – even one that increased its capacities through expanded involvement of military and corporate competencies – will probably not be able to respond in ways that are timely or necessarily appropriate.[25] In this sense, the importance of enhanced local capacities becomes of fundamental importance.

It has become a given that when it comes to disaster response, the involvement of local peoples, including local companies, is the first line of action.[26] In that sense, disaster preparedness – or the commitment to work with local authorities and communities – to strengthen their competencies only makes sense. Yet, in light of the inevitable overstretch that will occur when such communities may be caught in one or more simultaneous crises, identification of potential vulnerabilities and subsequent capacity strengthening will be essential for mapping potential risks and also for preparing for those too difficult to reduce.

[iii] *sequential crises*. Policy-makers and practitioners, too, have to take into account the cascading effects of a single crisis driver that may trigger a range of other crises. Such sequential crises are not hard to imagine. The earthquake that destroys a dam which in turn generates flooding that has extensive impacts upon local livelihoods, which then leads displaced populations to flee to neighbouring lands that triggers communal conflict is by no means improbable. Water or its increasing scarcity is certainly seen as such a trigger.

The consequences of the lack of water are by no means new, and serve as a harrowing reminder of the way that water scarcity as a crisis driver can readily lead to drought and famine, loss of livelihoods, the spread of water-borne diseases, forced migration and even open conflict. Such a spectre has been referenced directly and indirectly over the past decade as have been possible solutions.[27] And while such practical solutions range from those that are globally aspirational to those that are technically specific, there is an abiding message for those concerned with disaster risk reduction. The DRR process, beginning with risk identification, needs to take into account not only the inter-relationship between different crisis drivers, but also possible sequencing patterns.

One of the most challenging aspects of identifying such sequencing patterns and the inter-relationships between potential crisis drivers stems from the ways that government departments approach risk identification. In the United Kingdom, the 1987 hurricane that hit the south east of England demonstrated some of the worst aspects of risk identification, namely, the

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27 The past decade has witnessed a plethora of relevant global and country-specific analyses. Some recent examples include UNESCO, ***The UN World Water Development Report 2009***; the World Bank, ***India's Water Economy: Bracing for a Turbulent Future*** and ***Pakistan's Water Economy: Running Dry*** and the Asia Society, ***Asia's Next Challenge: Securing the Region's Water Future***.

failure to see the inevitable sequence of impacts that could be caused by an single crisis driver. Two decades later, a relatively effective risk identification methodology has been developed in which through a Natural Hazards Team in the Cabinet Office, potential disaster sequencing is not only identified, but on-going activities are undertaken to reduce the impact of such sequencing.[28]

Disaster Risk Reduction in a Futures Context

In one brief moment of time the 11 March 2011 Japanese earthquake demonstrated to the international community the perverse interconnection between natural hazards and catastrophic vulnerability. The 8.9 Richter scale earthquake which occurred 130 km off Japan's coast led to a massive Tsunami and at the same time disrupted critical sections of Japan's power grid. This disruption affected the power supply to the Fukushia Daiichi nuclear power plant that was needed to cool spent fuel. Back-up generators kicked in, but were disabled when the Tsunami struck the plant. The loss of power to the nuclear plant caused partial meltdowns of three of its reactors, causing the worst nuclear disaster since the Chernobyl meltdown in 1986.

The loss of human life has reached 10,000, but the full consequence of the trauma and suffering emerging from these events will not be accurately calculated for years to come.

As the government released over US$ 33 billion to calm the markets, it became apparent that the direct cost of these events may well reach US$ 100 billion, and some forecasts suggest indirect costs could reach US$ 1 trillion. At the same time, it is evident that even in this highly sophisticated and well prepared society, the impact of natural hazards on infrastructure can quickly lead to those outcomes normally associated with poorer countries -- large-scale food shortages, water and shelter crises and logistics collapse.

The earthquake, its aftershocks, the tsunami, the nuclear emergency and their potential financial costs illustrate what a "synchronous failure" could look like, namely, a multi-sectoral system's collapse. It is a type of failure for which the international community will increasingly have to prepare, one which has to begin with ever more sophisticated ways of anticipating and analyzing risks and ways to reduce them.

[28] The Natural Hazards Team has screened nearly 1000 critical national infrastructure sites for flood risk across nine sectors and identified 171 that are in areas that could flood from rivers or the sea and how each could be affected and how each could affect the other. The sectors included communications, emergency services, energy, finance food, health, transport and water. The lead Government departments are preparing a Sector Resilience Plan for each sector to understand the vulnerability of these 171 sites from flooding and to identify what actions are needed to improve resilience to disruption from natural hazards. DEFRA, ***The Government's Response to Sir Michael Pitt's Review of the Summer 2007 Floods: Progress Report***, December 2009, pp.15ff

Dealing with the *what might be's*

It would seem that every age regards itself as unique – as a transformational period in the evolution of human history. In various ways underpinning that sense of uniqueness are themes of uncertainty and complexity – that even while history may be a useful guide to the future, most accept that their ages are circumscribed by dimensions of the unknown that few other times have had to confront. This is certainly true of the first decade of the 21st century where issues of complexity and uncertainty reflect a major policy as well as academic theme.[29]

More and more governmental and related military as well as corporate sectors are dealing with complexity and uncertainty by speculating about the *what might be'*s, or developing plausible scenarios and simulations about the types of factors that might affect their strategic and operational objectives. While the process and consequences for governmental organisations of this focus on "anticipation" is discussed elsewhere,[30] it is important to note that as one engages more and more with anticipatory approaches to crisis management and risk reduction, the danger is to see the effort in terms of "prediction" and forecasting.

Anticipatory methodology in this instance is about enhancing individual as well as institutional sensitivities to plausible though not necessarily evident threats and solutions, possible inter-relationships between science and policy-making, and identification of new dimensions of collaboration and innovation. It is not about forecasting or prediction. Its purpose is to provide space and time to look for possible causal factors and inter-relationships which in this instance points to types of possible disaster risks and ways to reduce their effect.

The relevance of anticipatory methodology to this chapter is at least three fold. In the first place, anticipatory methodology moves planners away from the limitations of trends analysis, and offers opportunities to speculate about possible and plausible crisis drivers without the limitations imposed by only looking at the future as an extension of the past. This sort of speculative planning is increasingly accepted in a growing number of organisations in the commercial and military sectors, and Shell Petroleum's scenario-based futures work triggered a strategy development process that benefited many sectors though rarely those involved in humanitarian prevention, preparedness and response.

Secondly anticipatory methodology promotes connections that normally are not made in conventional strategic and operational planning. In light of the challenges that increasingly the humanitarian/development community at large, including those who specialise in risk reduction, the need for more innovative approaches to identify and mitigate risk requires collaborative partners who can expand the range of possible next moves. As one observer

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30 See: Chapter:_____ HFP submission for GAR-11

of the innovative process recently explained, “Good ideas are networks,” they normally arise out of “the connected mind.”[31]

A third reason for anticipatory methodology in this context is that it serves as a check to speculate about the relevance and durability of existing risk reduction programmes and projects. All too often DRR initiatives address the evident, but the challenge will increasingly be the extent to which such initiatives can also address the *what might be*’s. If this “check” seems too abstract or too unrelated to what all too often is referred to as “the real world,” the rejoinder might well be that such techniques are fundamental to military as well as corporate planning – both sectors that take the reality of risk extremely seriously.

Risk reduction complexities[32]

Urban growth leads to increases in the numbers of built structures (buildings, roads, bridges, etc.). This means that urban ground surfaces become more resistant, or impervious, to rainfall. This will exacerbate run-off, making it more extreme and unpredictable (e.g., Haase and Nuissi, 2006), and lead to localized flash flooding and overwhelming of sewer systems, which in turn can contaminate water bodies that are used for drinking and urban irrigation. Flooding will be exacerbated by urbanization in another way: that is, that the process of urbanization modifies the urban climate, leading to increased precipitation and heavier and more frequent thunderstorms. In their study of the city of Liepzig, Haase and Nuissl (2007) showed that surface runoff had more than doubled in the city area between 1940 and 2003 due to the increase of impervious surfaces. These authors found a corresponding decrease in the overall evapotranspiration from the soils of the urbanized area. By sealing soils to create built structures, their capacity to soak up contaminants is reduced. Any contaminants deposited on the impervious surfaces will therefore be washed away into receiving water bodies and thus reduce their quality (Xian et al., 2007).

In a world in which the probability of ever more complex risks are abundantly apparent, reducing disaster risks will have to take into account the changing types of crisis drivers as well as their changing dimensions and dynamics.

[31] Steven Johnson, ***Where good ideas come from***, Allan Lane, London, 2010, p.…

[32] [[Karin Hudson-Edwards and Noah Raford, Urban Catastrophes: The Wat/San Dimension, HFP/KCL, 2009, p.8 – RCK to complete references in box]]